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Economic Returns from Well Managed Farm Woods

John Aughanbaugh

OHIO AGRICULTURAL EXPERIMENT STATION
Wooster, Ohio

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ECONOMIC RETURNS FROM WELL MANAGED FARM WOODS

JOHN AUGHANBAUGH

INTRODUCTION

Most of Ohio's original forests, consisting of some of the finest hardwoods in eastern United States, have of necessity been cut as population increased. Woodlands today are too often grazed repeatedly, over-cut, high-graded,[1] or otherwise abused or neglected. These woods, irrespective of site potential, ready accessibility, market demands, and good roads, seldom measure up to expectations. Forestry on the farm, meaning intelligent farm-woods management for profit, should assume a role of increasing importance to the agricultural and industrial economy of a prosperous state such as Ohio.[2]

Aware of these state-wide problems of long standing, the Forestry Department at Ohio's Agricultural Experiment Station in 1945 initiated a long-range research program of experimental forests to be managed intensively with continuous inventories being taken.[3] These tracts of 6 to 60 acres each now number 27 in all, and are located in 23 counties of eastern Ohio (Figure 1). Goal of management is to build up productivity of each research-demonstration tract, to determine the profits resulting when timber is treated as a farm crop.

THE McNISH FARM-WOODS

This report pertains to Experimental Forest No. 6, which is an outstanding farm-woods in northeastern Ohio. The owner is Howard McNish of Burton and the forest is located in Claridon Township, Geauga County. It is an 18-acre, all-age, beech-maple stand[4] and is furnishing important research information on timber growth and yield under management. It serves, too, as do other experimental tracts, to demonstrate correct cultural practices to woods owners, sawmill operators, and to the general public.

The habitat comprises Wooster silt loam, a soil type derived from glacial till and rated to be of moderately high fertility. Situated atop

[1]To cut none but the best trees, and leave the poorest, until eventually the stand is worthless.

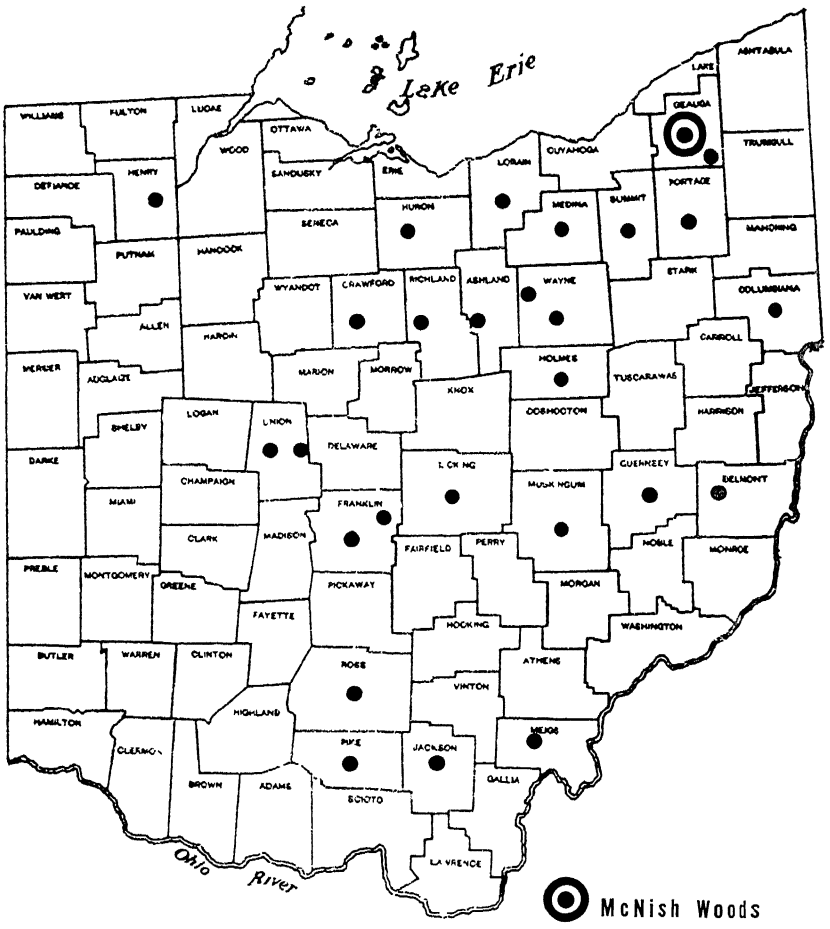
[2]Preston, J. F. 1954. Developing Farm Woodlands. McGraw-Hill Rural Activities Series. New York City, N. Y.

[3]Diller, O. D. Oct. 1957. Forest Research at the Ohio Agricultural Experiment Station, Wooster, Ohio. Reprint from Northeastern Logger.

[4]The term "all-age" signifies the presence of trees of all sizes—seedlings, saplings, poles and mature trees—ideally, with each class adequately represented. "Beech-maple" refers to one of Ohio's major forest types.

an upland flat, the forest has various low spots which retain standing water after heavy rains.

McNish's woodland supports a mixed hardwood growing-stock, consisting mainly of hard and soft maples, tuliptree, red oak, beech, and hickory. Scattered associates of importance include cucumber magnolia, ash, elm, cherry, and walnut. Represented, too, are white oak, basswood, yellow birch, sycamore, blackgum, and hophornbeam.



DISTRIBUTION OF
EXPERIMENTAL FORESTS IN OHIO

FIGURE 1.

Fig. 2.—Some 12,000 board feet of tuliptree logs were harvested in 1940 from this 18-acre tract and sawed into boat stock. Since its establishment as an experimental farm-woods in January 1946, a total of 2,977 net board feet per acre of selectively marked trees have been cut.

Tree heights and stand density denote a timber-growing potential considerably above the Ohio average.

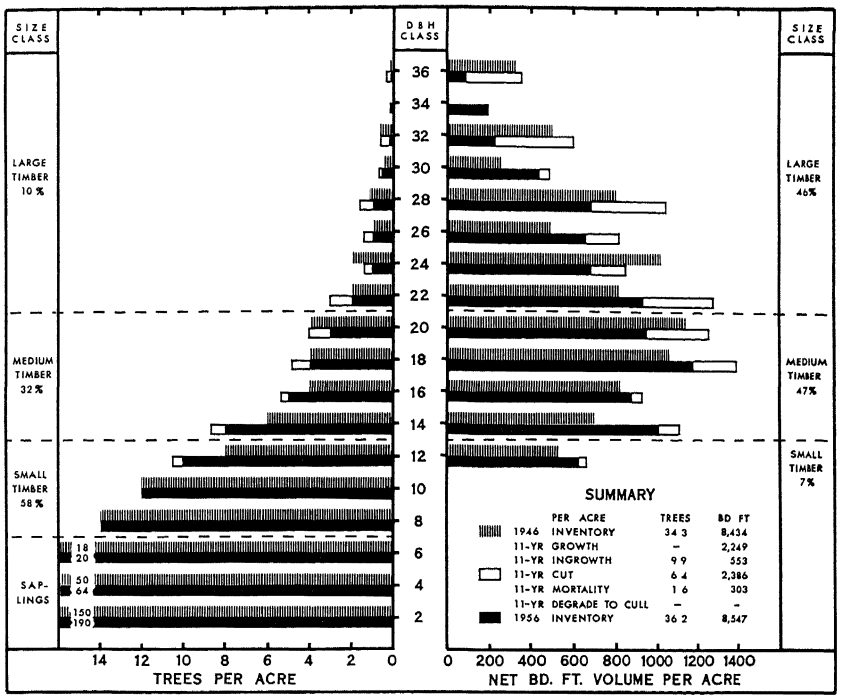
The forest has been worked intensively as a sugar-bush[5] for many years. Fenced to exclude livestock about 1940, it now contains a conspicuous understory of young trees (cover photo).

CONTINUOUS INVENTORY

In December 1946, the McNish woods was made available on a cooperative basis for forest research. At that time 45 permanent one-fifth-acre sample plots, uniformly distributed, were established within the stand. Detailed measurements of 1,163 paint-numbered trees in the plots, taken during January 1946, October 1950, November 1956 and November 1961, are recurrent features of the continuous inventory. These trees make it possible to gauge periodic growth, ingrowth,[6] mortality and cut attributable to each species and to the

[5]A woods utilized for maple syrup production.

[6]Ingrowth refers to trees initially entering the sawlog-size class (11.0"+).



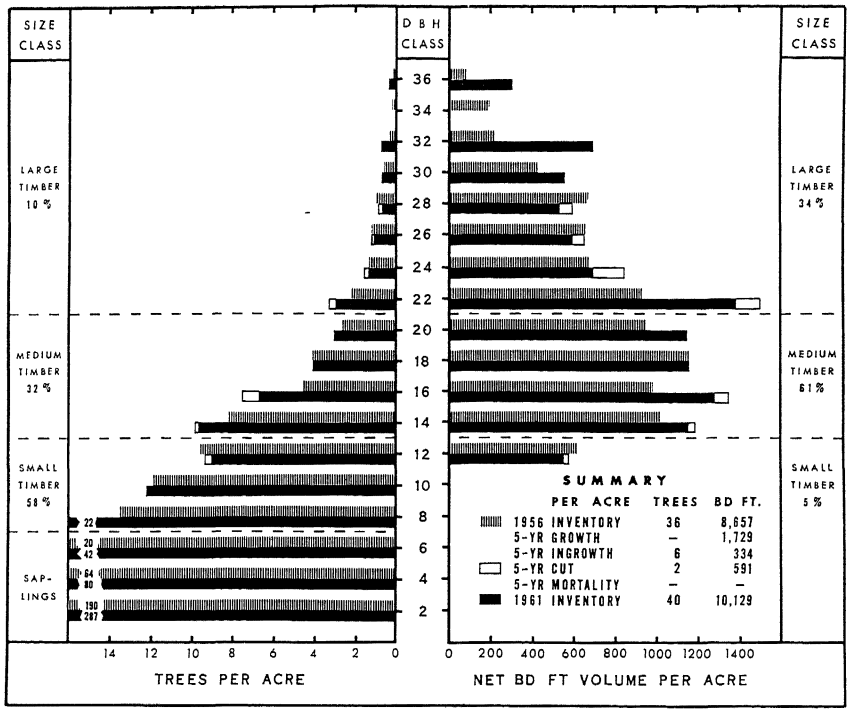
GROWING-STOCK IN McNISH WOODS
CLARIDON TOWNSHIP, GEAUGA COUNTY, OHIO
1946 - 1956

FIGURE 3

tract as a whole. These are expressed on a per acre basis (Summary, Figs. 3 and 4; and Table 1). Defect deduction factors (Table 1, footnote), when applied to sawtimber-size trees (11.0″ d.b.h. and up*), determine the merchantable board foot content, International log scale.

At each reinventory the timber is marked conservatively for improvement cuts, planned so as to accelerate growth and to advance the earning capacity of the forest (Tables 2 and 3). Trees of poor vigor whether defective or deformed are then selected for removal. Those of desired species and in thrifty condition regardless of size, unless over-mature, are retained. Management strives for a profitable and continuous production of high-quality forest products. One-half to one man-day per acre devoted annually to constructive woods work insures in due time an ideal stand.

*d. b. h. means diameter breast high (4 ½ feet above ground) measured with a specially designed steel diameter-tape.



GROWING-STOCK IN McNISH WOODS
CLARIDON TOWNSHIP, GEAUGA COUNTY OHIO
1956-1961

FIGURE 4

Frequent improvement cuts provide McNish and a tenant with home-use building materials, fence posts, fuel and sugar woods. The best sawlogs are marketed (Fig. 2), a practice considerably more profitable than that of selling stumpage.[7] Farmers conducting efficient timber harvests further the cause of "farm forestry", a relative newcomer to the realm of agribusiness.

Records of the harvested wood, the value of that used and sold, and the labor required in processing and marketing are a necessity for successful farm-woods management. Few farmers keep detailed accounts of woods operations. Without records to show earnings, the place of a forest in the farm enterprise cannot be appreciated.

[7]Stumpage is standing sawtimber.

TABLE 1.—Comparative Growth By Species in McNish Farm-Woods.
(Data on per acre basis)

Tree Species	Trees of Sawlog-Size (Number)				Net Volume[1] (Bd. Ft.)				Periodic Annual Growth (Percent)		
	1946	1950	1956	1961	1946	1950	1956	1961	1946-50	1950-56	1956-61
Sugar maple	9.8	9.9	9.7	10.7	2,234	2,340	2,491	3,033	1.9	2.4	4.6
Red maple	5.6	6.0	7.0	7.8	1,361	1,546	1,798	2,126	2.4	2.5	4.1
Tuliptree	4.7	4.3	4.9	4.8	1,438	1,344	1,807	1,858	2.8	4.1	3.4
Hickory	3.8	3.8	3.4	3.0	630	646	569	643	1.9	3.3	3.4
Beech	2.7	2.1	1.8	2.1	614	472	428	508	2.4	5.5	3.7
Cucumber	1.7	1.7	1.3	1.5	374	379	347	428	2.7	4.4	4.0
Red oak	1.2	0.9	1.2	1.4	893	290	339	457	3.0	9.8	6.1
White ash	0.6	1.4	2.8	4.2	35	111	273	446	6.8	13.3	6.4
American elm	1.1	1.2	1.7	2.3	243	122	174	249	3.3	4.0	6.1
Black cherry	1.0	0.9	1.1	1.2	271	207	182	225	2.5	1.7	4.0
Others[2]	2.2	1.4	1.7	1.2	341	199	249	156	3.3	2.9	8.1
Total	34.4	33.6	36.6	40.2	8,434	7,656	8,657	10,129	2.4 (av)	3.8 (av)	4.3 (av)

[1]International log scale. Defect deduction factors, determined individually for each tree are as follows: 1=3%; 2=7%; 3=14%; 4=22%; 5=35%; 4D (cull)=less than 50% merchantable.

[2]Includes butternut, black walnut, basswood, white oak, yellow birch, red elm, blackgum, sycamore, blue (water) beech, and hophornbeam.

TABLE 2.—Trees Marked to Cut in McNish Woods on 18 Acres. December 1961.

Species	Number of Trees with Painted X's on Trunk Diameter Class (Inches)														Totals
	4″	6″	8″	10″	12″	14″	16″	18″	20″	22″	24″	26″	28″	30″+	
Beech	8	5	2		2		(1)*			1 (1)	1		1		20 (2)*
White Ash	9	5	9	3	1										27
Red Maple	1	3	4	3	2	1	1	1	1	(1)	1	1		3 (1)	23 (2)
Sugar Maple	6	7	2	4	(2)	1 (1)		(1)		1	2	(1)	1	1	24 (5)
Basswood	2	1	1	3						1					8
Cucumber			2	1	3		1	2							9
Tuliptree						1									1
Hickory[1]	13	5			2	2	1	2	2	2					29
Elm[2]	10	2	7	3	1	1		1			(1)				25 (1)
Black Cherry	4	5	1	1		1	1								13
Butternut			1	1	1	1									4
Red Oak														1	1
Sycamore			1												1
Blackgum					1										1
Ironwood[3]	233	90	27	8											358
Totals	286	123	57	27	13 (2)	8 (1)	4 (1)	6 (1)	3	5 (2)	4 (1)	1 (1)	2	5 (1)	544 (10)

*Cull trees are entered in parentheses. We consider a tree a "cull" if less than 50% of its trunk (otherwise usable) is merchantable for lumber.

[1]Includes shagbark, bitternut and pignut hickories.

[2]Includes American and red (slippery) elms.

[3]Includes hophornbeam and blue (water) beech.

TABLE 3.—Tree Volumes Marked to Cut in McNish Woods on 18 Acres. December 1961.

Species	Volume in Cords D. B. H. Class				Volume in Bd. Ft. by International Log Scale Diameter Class (Inches)										Total Bd. Ft.
	4″	6″	8″	10″	12″	14″	16″	18″	20″	22″	24″	26″	28″	30″+	
Beech	.120	155	.172		104					190	431		597		1,322
White Ash	.135	.155	.774	.471	57										57
Red Maple	015	093	.344	.471	114	140	213	235	295		431	604	597	2,017	4,646
Sugar Maple	.090	.217	.172	.628		140				362	777			408	1,687
Basswood	.030	031	086	.471						362					362
Cucumber			172	.157	214		147	466							827
Tuliptree						110									110
Hickory[1]	195	.155			180	242	59	376	465						1,322
Elm[2]	150	062	.602	.471	57	110		188							355
Black Cherry	060	155	.086	.157		79	147								226
Butternut			086	.157	57	140									197
Red Oak														794	794
Sycamore			.086												
Blackgum					57										57
Ironwood[3]	3.459	2.790	2.322	1.256											
Totals	4.254	3.813	4.902	4.239	840	961	566	1,265	760	914	1,639	604	1,194	3,219	11,962

[1]Includes shagbark, bitternut and pignut hickories.
[2]Includes American and red (slippery) elms.
[3]Includes hophornbeam and blue (water) beech.

NOTE: To the above total of 17 cords in small trees can be added about 11 cords of usable tops and limbs from sawlog-size trees; thus making it possible, with close utilization, to harvest about 28 cords (in addition to sawlogs) from the marked trees.

FOREST DEVELOPMENT

With years of care this sugar-bush now ranks as a productive and attractive farm-woods. Defects exist principally in overmature maple, a common problem because operators usually insist on retaining every sap-yielding tree irrespective of its grade or vigor. Yet the charts (Figs. 3, 4 and 5) covering the period 1946-1961 depict many favorable changes in the overall forest conditions.

Merchantable standing volume has enlarged steadily, despite a periodic cut of 2,977 board feet per acre, during the past 16 years (Summary, Figs. 3 and 4). This came about because interim harvests seldom exceeded the increment. Also, ingrowth supplemented volume. Growth plus ingrowth surpassed by nearly 1,600 bd. ft. the drain due to cut and mortality. Natural loss from mortality will be practically nil if trees of declining vigor are noted and felled. Planned harvest cuts based on marked trees then permit the forest's productive capacity to constantly build up.

Another method of gauging volume increase is the basal area[8] performance record (Fig. 5). This gives a helpful overall picture of the stocking by size-classes. Note that the graph portrays a well-balanced pattern of forest development.

Sawtimber stocking per acre advanced from 8,434 feet net[9] in 1946 to a net of 10,129 feet in 1961 (Summary, Fig. 3 and 4). It is significant that McNish has also harvested more than 53,000 feet from his 18-acre tract since 1946. This record exemplifies a silvicultural axiom: "Due to allotment of ample space to good crop trees, their volume increase more than compensates for those cut."

Figure 4 depicts graphically the stand structure by size-classes, from saplings and poles to mature trees. Small timber (8″-12″ d.b.h.) contributes 58 percent by tree number, 5 percent by volume; medium timber (14″-20″ d.b.h.) 32 percent in trees, 61 percent in volume; and large timber (22″-36″ d.b.h.) 10 percent in trees, 34 percent in volume. As the bar-graph shows, this distribution follows a parabolic pattern characteristic of the well-stocked, all-age woods.

An average acre now holds 40 sawtimber-size trees, that is, trees exceeding 11.0″ d.b.h. (Summary, Fig. 4). Ingrowth contributes yearly 1.2 trees of that size per acre.

A majority of the butt-logs will provide quality wood products bringing high prices. These are in demand for veneer, cooperage, handle stock, or select sawed lumber. Ohio can use many such farm-

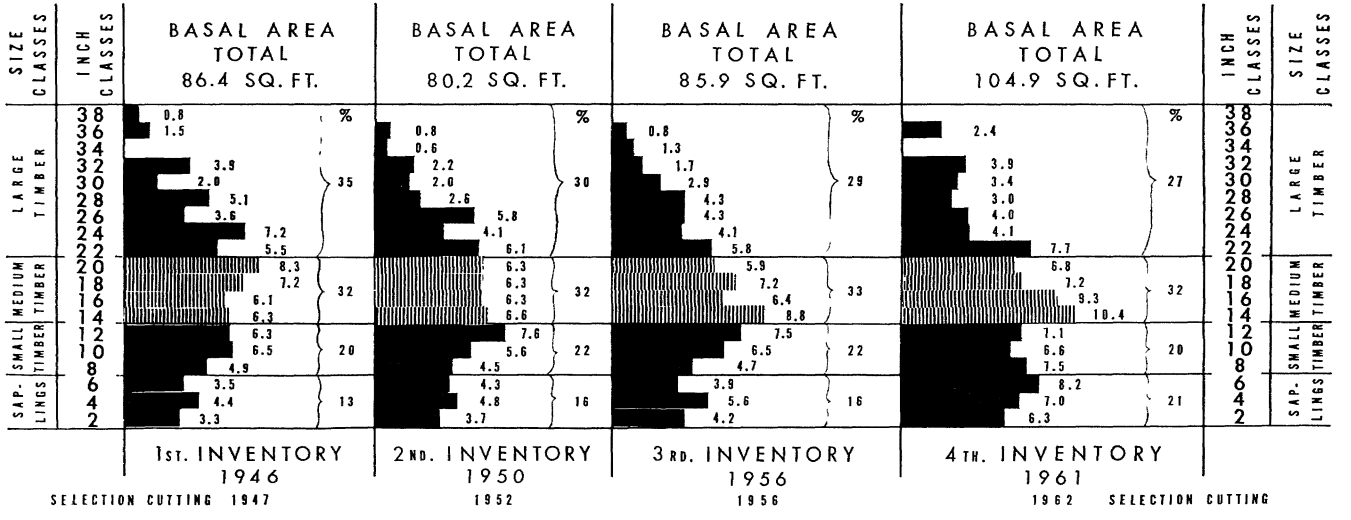
[8]Sum of the cross sectional areas (sq. ft.) of trees measured at breast height.

[9]After deducting cull and defect from gross wood volume.

FIGURE 5

GROWING-STOCK AT EACH INVENTORY
OF THE McNISH FARM-WOODS

EXPRESSED IN SQUARE FEET OF BASAL AREA PER ACRE



SCALE OF BASAL AREA — ■ — EQUALS 2 SQUARE FEET

	SAPLINGS 2 – 6 Inches	SMALL 8 – 12 Inches	MEDIUM 14 – 20 Inches	LARGE 22 Inches +	
1946	13 %	20 %	32 %	35 %	1946
1961	21 %	20 %	32 %	27 %	1961

woods to supply the mounting requirements of the state's wood-using industries.

Incidentally, the McNish tract was the first of Ohio's experimental forests to support 10M net bd. ft. or more of sawtimber per acre (Summary, Fig. 4). It is expected to advance to full or optimum stocking at about 12M bd. ft. of sound growing-stock. Thereafter it will be able to sustain light annual cuts equivalent to its current increment, in addition to production of maple syrup. The sugaring operation has yielded some 300 or more gallons yearly.

Current annual increment[10] has reached 346 net bd. ft. per acre per year, after advancing steadily, as follows (Figs. 3 and 4):

1946 - 1950_____157 net bd. ft. per acre per year
1950 - 1956_____262 net bd. ft. per acre per year
1956 - 1961_____346 net bd. ft. per acre per year

Forest growth at present (Table 1) is equivalent to 4.3 percent simple interest annually, which is a substantial and dependable contribution to the farm enterprise.

SPECIES COMPOSITION

Table 1 gives the growth records of the component tree species. Hard maple, which predominates, grows more slowly than many but is prized for the syrup and specialty wood products it provides; and in a sugarbush it obviously has priority.

Preferred species to favor in this or any woods, where trees possess proper form and vigor include ash, walnut, oak, tuliptree and cucumber magnolia. Least desirable are beech, hickory, ironwood, and blackgum. Elm's susceptibility to disease warrants its early removal.

Ironwood a Problem

Silvicultural problems exist in even a well-tended stand. Here, as is often the situation in Ohio, ironwood has secured a firm hold in the understory. Popular usage of the term "ironwood" includes both the hophornbeam (*Ostrya virginiana* Mill.) and the blue or water beech (*Carpinus caroliniana* Walt.). Usable as fuelwood but rarely reaching sawtimber size, these species rank as woodland "weeds"[11] which retard the establishment of preferred species.

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[10] C. A. I. = $\frac{\text{Growth between inventories}}{\text{No. of interim growing-seasons}}$

[11] It is well to remember that the despised species of today may become the prized one of tomorrow, dependent on changing market conditions.

Status of Ironwood in the Understory
(Data on per acre basis)

	2-Inch		4-Inch		6-Inch		8-Inch		10-Inch	
	A	B	A	B	A	B	A	B	A	B
Saplings (No.)	287	57	80	11	42	13	22	2	12	0.3
Ironwood (%)	20%		14%		30%		9%		3%	

A = all species coubined; B = irronwood

Unwanted ironwoods were marked to cut, girdle, or poison at the recent inventory (Table 2). Ridding the woods of these undesirable trees is comparable to removing the weeds from cultivated field crops. Stumps of cut trees should be treated with herbicide, preferably "brush killer" (2,4-D and 2,4,5-T), to prevent sprouting.

Hickory Increasing

The steady spread of hickory (shagbark, bitternut and pignut) in this woods poses another problem for solution. Its representation in the understory is today as follows:

Status of Hickory in the Understory
(Data on per acre basis)

	2-Inch		4-Inch		6-Inch		8-Inch		10-Inch	
	A	B	A	B	A	B	A	B	A	B
Saplings (No.)	287	20	80	22	42	9	22	7	12	3
Hickory (%)	7%		28%		21%		32%		25%	

A = all species combined; B = hickory

Hickory nuts possess food value for wildlife and human consumption, but the wood has little commercial value. It formerly was much in demand for fuel, tool handles, sucker-rods, light vehicles, meat smoking, and various minor purposes. It is rarely sawed into lumber because when seasoned the wood is too hard to nail.

Besides restricted usefulness, hickory's inherent traits favor its spread in the farm-woods of Ohio. It is planted by squirrels which bury the nuts, with the apparent expectation of digging them up later; but occasionally these are missed and eventually germinate. Young hickory trees are hardy and aggressive, as exemplified by their long tap-root, sprouting capacity, relative freedom from defect, and rapid juvenile development.

Special efforts are needed to curb the undue spread of hickory in a managed stand.

CONCLUSIONS

Ohio's experimental forest program is now providing reliable information on the dividends possible from a well-managed small woodland.[12] Timber represents a renewable resource which, in general,

[12]Aughanbaugh, J. E. 1959. Experimental woodlands as a means of encouraging improved management of small tracts. Journal of Forestry, Vol. 57, No. 8.

has been abused and neglected by private owners who still control the majority of the forest land. Some foresters believe the best way of inducing owners to practice forestry is the offer of large subsidies through ACP payments, reduced taxes, long-term loans, and free advice. Others believe that research and education can demonstrate that proper woodland care is worthwhile and will persuade more owners to give forestry a trial.

Farm forestry relies as much perhaps on the profit motive as on other benefits indirect or intangible. More well managed wooded acres could raise the standard of living on many Ohio farms.

The McNish farm-woods serves as a meaningful example to others, as well as a source of justifiable pride and satisfaction to its owner.